MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

PTG 0116 – TRIGONOMETRY AND COORDINATE GEOMETRY

(All sections / Groups)

2 MARCH 2017
9:00 a.m – 11:00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 3 pages with 4 questions and an appendix.
2. Answer all questions.
3. Unless stated otherwise, if an answer is given as a decimal, it should be rounded to **four** significant figures.
4. Write your answers in the Answer Booklet provided.
5. Show all workings.

Question 1

(a) If $\cos\theta = -0.8244$ and $\csc\theta < 0$, find θ in radians for $0 \le \theta \le 2\pi$. [4 marks]

(b) Verify the identity $\dfrac{\sin\theta}{\csc\theta - \cot\theta} = 1 + \cos\theta$. [4 marks]

(c) Solve the trigonometric equation $\cos\dfrac{\theta}{2} = 1 + \cos\theta$ for $0 \le \theta \le 2\pi$. [8 marks]

(d) Calculate the shaded area of overlapping circles shown in Figure 1. Both circles are with radius of 2.7 m. Distance between the centres PQ is 4.2 m. [9 marks]
Note: Area of a sector of a circle with radius r is $\frac{1}{2}r^2\theta$, where θ is in radian.

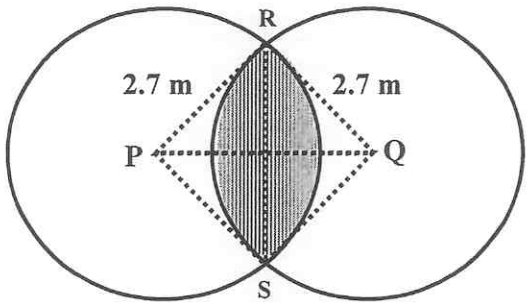

Figure 1

Question 2

(a) Perform the following. Leave the answer in rectangular form.

(i) $\dfrac{(6\angle 130°)(2\angle 45°)}{1 + i\sqrt{3}}$ [3 marks]

(ii) $[2.78(\cos 56.8° + i\sin 56.8°)] + [1.37(\cos 207.3° + i\sin 207.3°)]$ [3 marks]

(b) (i) Evaluate $-\sqrt{-49} - i^{15}$. [4 marks]

(ii) Find the cube roots of the answer obtained in (b)(i). Leave the answer in rectangular form. [7 marks]

(c) Given $\mathbf{p} = 2\mathbf{i} - \mathbf{j} + \mathbf{k}$ and $\mathbf{q} = \mathbf{i} + 2\mathbf{j} - 3\mathbf{k}$.

(i) Find $(2\mathbf{p} + \mathbf{q}) \times (\mathbf{p} - 2\mathbf{q})$. [4 marks]

(ii) Determine the angle θ between $\mathbf{p}$ and $\mathbf{q}$ for $0 \le \theta \le \pi$. [4 marks]

Question 3

(a) Determine the value of k for the following:

(i) The midpoint of the line segment from (-4, k) to (6, 1) is (1,5). [2 marks]

(ii) The distance between the points (11, k) and (-1, 3) is 13. [3 marks]

(iii) The points (6, -1), (3, k) and (-3, -7) are on the same line. [4 marks]

(b) Find the equation of the ellipse with foci at (1, 3) and (9, 3) and length of major axis equals 10. [7 marks]

(c) Identify the type of curve represented by the following equations. Find the centre (or vertex if it is a parabola). Sketch each curve.

(i) $\dfrac{(x+4)^2}{4} + \dfrac{(y-1)^2}{1} = 1$ [5 marks]

(ii) $(x+3)^2 = -12(y-1)$ [4 marks]

Continued...

Question 4

(a) Given $A=\begin{bmatrix}0 & 3 & -1\\ 1 & 2 & -4\end{bmatrix}$, $B=\begin{bmatrix}-4 & 1 & 0\\ -2 & 3 & -2\end{bmatrix}$, $C=\begin{bmatrix}4 & -1\\ 1 & 0\\ 2 & 1\end{bmatrix}$ and $D=\begin{bmatrix}1 & 0 & -1\\ 2 & 1 & 0\\ 0 & -3 & 1\end{bmatrix}$,

solve the following:

(i) $3A-2B$ [3 marks]

(ii) $5C^T$ [2 marks]

(iii) $CA+3I_3$ [4 marks]

(iv) D^{-1} [10 marks]

(b) Find y in the following linear system using Cramer's rule.

$$3x+3y+z=9$$
$$x+2y+z=8$$
$$2x-y+z=1$$

[6 marks]

Continued...

APPENDIX

$$\sin^2\theta+\cos^2\theta=1$$
$$\tan^2\theta+1=\sec^2\theta$$
$$1+\cot^2\theta=\csc^2\theta$$

$$\cos(A+B)=\cos A\cos B-\sin A\sin B$$
$$\cos(A-B)=\cos A\cos B+\sin A\sin B$$
$$\sin(A+B)=\sin A\cos B+\cos A\sin B$$
$$\sin(A-B)=\sin A\cos B-\cos A\sin B$$
$$\tan(A+B)=\frac{\tan A+\tan B}{1-\tan A\tan B}$$
$$\tan(A-B)=\frac{\tan A-\tan B}{1+\tan A\tan B}$$

$$\sin 2A=2\sin A\cos A$$
$$\cos 2A=\cos^2 A-\sin^2 A$$
$$=2\cos^2 A-1$$
$$=1-2\sin^2 A$$
$$\tan 2A=\frac{2\tan A}{1-\tan^2 A}$$

$$\sin^2 A=\frac{1-\cos 2A}{2}$$
$$\cos^2 A=\frac{1+\cos 2A}{2}$$
$$\tan^2 A=\frac{1-\cos 2A}{1+\cos 2A}$$
$$\tan A=\frac{\sin 2A}{1+\cos 2A}$$
$$=\frac{1-\cos 2A}{\sin 2A}$$

$$\sin A\cos B=\frac{1}{2}\left[\sin(A-B)+\sin(A+B)\right]$$
$$\cos A\cos B=\frac{1}{2}\left[\cos(A-B)+\cos(A+B)\right]$$
$$\sin A\sin B=\frac{1}{2}\left[\cos(A-B)-\cos(A+B)\right]$$

$$\sin A+\sin B=2\sin\frac{A+B}{2}\cos\frac{A-B}{2}$$
$$\sin A-\sin B=2\cos\frac{A+B}{2}\sin\frac{A-B}{2}$$
$$\cos A+\cos B=2\cos\frac{A+B}{2}\cos\frac{A-B}{2}$$
$$\cos A-\cos B=-2\sin\frac{A+B}{2}\sin\frac{A-B}{2}$$

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